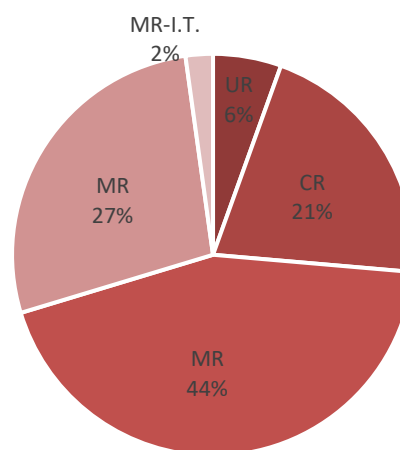


# Associate Diploma of Science in Electrical Engineering

## An Exit Qualification from the Electrical Engineering B.Sc. Program for Students Admitted to B.SC Program (2014-2022)

### Program Components

| Course Type                 | CRD       |
|-----------------------------|-----------|
| University Requirement (UR) | 5         |
| College Requirement (CR)    | 19        |
| Major Requirement (MR)      | 40        |
| MR-Industrial Training      | 2         |
| <b>Total Credit (CRD)</b>   | <b>66</b> |



### List of Courses

#### University Requirements

| Course Code                              | Course Title   | Course Hours |      |     | Course Type | Pre requisite | Major GPA |
|--|--|--------------|------|-----|-------------|---------------|-----------|
|  |  | LEC          | PRAC | CRD |             |               |           |
| ARAB 110, or<br>HIST 122, or<br>ISLM 101 | Arabic Language Skills<br>Modern History of Bahrain and Citizenship<br>Islamic Culture | 3            | 0    | 3   | UR          | -----         | No        |
| HRLC 107                                 | Human Rights   | 2            | 0    | 2   | UR          | -----         | No        |

#### College Requirements

| course Code | Course Title                                      | Course Hours |      |     | Course Type | Pre requisite | Major GPA |
|-------------|---|--------------|------|-----|-------------|---------------|-----------|
|             |   | LEC          | PRAC | CRD |             |               |           |
| CHEMY 101   | General Chemistry I                               | 3            | 3    | 4   | CR          | -----         | No        |
| CSC 103     | Computer Programming for Scientists and Engineers | 3            | 2    | 3   | CR          | -----         | No        |
| ENGL 101    | Communication Skills I                            | 3            | 0    | 3   | CR          | -----         | No        |
| ENGL 102    | Composition and Reading II                        | 3            | 0    | 3   | CR          | ENGL 101      | No        |
| MATHS 101   | Calculus I  | 3            | 0    | 3   | CR          | -----         | No        |
| MATHS 102   | Calculus II                                       | 3            | 0    | 3   | CR          | MATHS 101     | No        |

### Major Requirements

| Course Code | Course Title                     | Course Hours |      |     | Course Type | Pre requisite                  | Major GPA |
|-------------|----------------------------------|--------------|------|-----|-------------|--------------------------------|-----------|
|             |                                  | LEC          | PRAC | CRD |             |                                |           |
| EENG 100    | Circuit Theory I                 | 3            | 1    | 3   | MR          | MATHS101                       | YES       |
| EENG 200    | Circuit Theory II                | 3            | 1    | 3   | MR          | EENG100                        | YES       |
| EENG 251    | Digital Systems I                | 3            | 1    | 3   | MR          |                                | YES       |
| EENG 261    | Electronic Devices and Circuits  | 3            | 1    | 3   | MR          | EENG100                        | YES       |
| EENG 262    | Analog Electronics               | 3            | 1    | 3   | MR          | EENG261                        | YES       |
| EENG 333    | Power Electronics I              | 3            | 1    | 3   | MR          | EENG261                        | YES       |
| EENG 341    | Electrical Machines I            | 3            | 1    | 3   | MR          | EENG200                        | YES       |
| EENG 355    | Microprocessors and Applications | 3            | 1    | 3   | MR          | EENG251                        | YES       |
| EENG 271    | Signals and Systems              | 3            | 1    | 3   | MR          | EENG200,<br>MATHS102           | YES       |
| EENG 334    | Power Electronics II             | 3            | 1    | 3   | MR          | EENG333                        | YES       |
| EENG342     | Electrical Machines II           | 3            | 1    | 3   | MR          | EENG341                        | YES       |
| EENG 311    | Power Systems I                  | 3            | 1    | 3   | MR          | EENG341                        | YES       |
| EENG 381    | Control Systems                  | 3            | 1    | 3   | MR          | EENG271                        | YES       |
| EENG 290    | Junior Project                   | 0            | 3    | 1   | MR          | Completion<br>of 55<br>Credits | YES       |

### Industrial Training

| Course Code | Course Title          | Course Hours |      |     | Course Type     | Pre requisite               | Major GPA |
|-------------|-----------------------|--------------|------|-----|-----------------|-----------------------------|-----------|
|             |                       | LEC          | PRAC | CRD |                 |                             |           |
| EENG 291    | Industrial Training I | 0            | 6    | 2   | MR-<br>Training | Completion<br>of 45 credits | Yes       |

---

## Courses Descriptions

---

---

### University Requirements Courses Descriptions

---

**Course Code:** ARAB 110

**Course Title:** Arabic Language Skills

This course focuses on basic Arabic skills, including form, function, and meaning. It also helps the student to appreciate and understand structures and approach them from a critical point of view, through various genres in literature.

**Course Code:** HIST 122

**Course Title:** Modern History of Bahrain and Citizenship

Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

**Course Code:** HRLC 107

**Course Title:** Human Rights

This course deals with the principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Economics, Social and Culture rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

**Course Code:** ISLM 101

**Course Title:** Islamic Culture

An introduction to the general outline and principles of Islamic culture, its general characteristics, its relationships with other cultures, general principles of Islam in beliefs, worship, legislation and ethics.

---

### College Requirement Courses Descriptions

---

**Course Code:** CHEMY 101

**Course Title:** General Chemistry I

Significant figures, chemical formulas and equations; mass relations, limiting reactions and theoretical yield; Physical behavior of gases; electronic structure, periodic table, covalent bonding; Lewis structures, Molecular structures, hybridization; molecular orbitals, solutions; colligative properties. Related practical work.

**Course Code:** CSC 103

**Course Title:** Computer Programming for Scientists and Engineers

Introduction to computers, their uses, development, components, hardware, and software. Internal representation and numbering systems. Algorithmic problem-solving principles. Introduction to a modern programming language (e.g. C++). Input/Output, conditional statements, iteration, files, strings, functions and arrays. Lab assignments to practice programming.

**Course Code:** ENGL 101

**Course Title:** Communication Skills I

This course focuses on reading skills and strategies and language development. The reading section concentrates on high-interest contemporary topics and encourages students to increase speed and efficiency. The writing component, integrated to the reading materials, reviews grammatical structures, develops language accuracy and introduces paragraph writing. Students are required to upgrade their grammar, reading, and listening skills on the internet.

**Course Code:** ENGL 102

**Course Title:** Composition and Reading II

A continuation of English 101, which further develops the students' skills in reading and writing. The course exposes students to a wider range of reading material aimed at developing their understanding of different styles of English.

**Course Code:** MATHS 101

**Course Title:** Calculus I

Algebra. Functions and graphs. Trigonometry. Conic sections. Limits and continuity. Derivatives and integrals. Applications of derivatives which include mean value theorem, extrema of functions and optimization. Definite integrals and the Fundamental Theorem of Calculus.

**Course Code:** MATHS 102

**Course Title:** Calculus II

Applications of definite integrals, including areas, volumes and surface areas of solids of revolution, arc length and centroids. Transcendental functions, indeterminate form and L'Hopital's Rule. Techniques of integration and improper integrals. Infinite series, power series. Maclaurin and Taylor Theorem.

---

## Major Courses Descriptions

---

**Course Code:** EENG 100

**Course Title:** Circuit Theory I

Circuit elements, Lumped circuits Kirchhoff's laws. Network theorems. Sinusoidal steady-state analysis, single phase and 3-phase balanced and unbalanced networks. Coupled networks, series and parallel magnetic circuits.

**Course Code:** EENG 200

**Course Title:** Circuit Theory II

Natural and forced response of first and second order RLC networks. Laplace transform and application phase concept. Analysis of linear time-invariant circuits. Convolution network graphs. Tellegen's theorem. More on time domain solution of networks by Laplace transformation. Frequency response, bandwidth and quality factor. Transfer function. State equation and Two-port networks. Computer aided analysis of circuits.

**Course Code:** EENG 251

**Course Title:** Digital Systems I

Number systems; Basic logic gates; Boolean algebra; Simplification of logic functions: Karnaugh maps, Quine-McCluskey method, NAND and NOR gates networks; Multiple output networks; MSI combinational logic circuits: Multiplexers, Decoders, Adders, Comparators; Tri-State logic; combinational logic circuits design with programmable logic devices: Memories, PLA, PAL; Flip-Flops; Design and analysis of counters and registers.

**Course Code:** EENG 261

**Course Title:** Electronic Devices and Circuits

Semiconductor fundamentals: carrier transport and recombination, doped materials, physics and applications of pn junction diode, Zener diode characteristics and applications, special purpose diodes, Fundamentals of BJTs and FETs, DC analysis of transistors circuits, Transistors as a switch, Transistor as an amplifier, small signal equivalent circuits, Biasing techniques, Basic single stage amplifiers.

**Course Code:** EENG 262

**Course Title:** Analog Electronics

Differential amplifiers, Multistage amplifiers: Cascade, cascade and Darlington pair configurations, Basic building blocks of op amp. Ideal op amp characteristics, positive and negative feedback applications of ideal op amp, non-ideal op amp, Frequency response of amplifiers, Feedback concepts and topologies, Filters, Output stage and power amplifiers.

**Course Code:** EENG 271

**Course Title:** Signals and Systems

Elementary continuous and discrete-time signals signal decomposition and convolution, sampling theory and Nyquist theorem, Laplace and Z transforms, Fourier series and integral with applications, Linear Time-Invariant (LTI) systems: Properties, impulse and frequency responses, Pole-zero description, input-output difference and differential equations, transient and steady-state time responses to elementary signals.

**Course Code:** EENG 290

**Course Title:** Junior Project

The course is meant to develop creative design skills in the students by exposing them to some ongoing important projects in the country and requiring them to submit report on a chosen project highlighting various design components. Field trips may be arranged in coordination with the industry. The project will emphasize independent learning and teamwork. The lectures will include introduction to electrical engineering profession, description of various areas of specialization, professional report writing techniques and the role of electrical engineers in the society.

**Course Code:** EENG 311

**Course Title:** Power Systems I

Introduction, per unit system. Synchronous machines: steady-state and parallel operation, operational limits. Transformers: three-phase, three winding, phase shifting, vector grouping, tap changing and harmonics. Transmission lines: parameters, sequence impedances, representation of short, medium and long transmission lines. High voltage cables, reactive power compensation. Travelling waves and over voltages.

**Course Code:** EENG 333

**Course Title:** Power Electronics I

Characteristics of power semiconductor devices: thyristor, GTO, diac, triac, power transistor, UJT, PUT, UJT and PUT, MOSFET and IGBT. Oscillators. Thyristor ratings and protection. Triggering circuits. Rectifiers: Uncontrolled and controlled, single and three phase, half and full wave rectifiers. Ripple filters. Voltage and current doublers. Single phase AC voltage regulators and inverters.

**Course Code:** EENG 334

**Course Title:** Power Electronics II

Review of characteristics of Power Devices: SCR, MOSFET, IGBT and light activated devices. Commutation techniques, DC-to-DC converters, Choppers, 3-phase AC voltage controllers, 3-phase voltage source and current source inverters based, Harmonics in rectifiers and inverters. Switch mode power supplies, Buck, Boost Buck-Boost and Cuk Converters, Protection of power devices. Application of power electronics to power systems.

**Course Code:** EENG 341

**Course Title:** Electrical Machines I

Magnetic circuits. Transformers: construction, equivalent circuit, parallel operation, auto-transformers. Electromechanical energy conversion, Force and torque produced in multi-winding devices. Production of rotating magnetic field. Machine windings: DC field windings, AC armature windings, EMF and MMF distribution in DC and three-phase AC windings. Single and Three-phase induction motors, SEIGs, Reluctance motors, full performance analysis.

**Course Code:** EENG 342

**Course Title:** Electrical Machines II

Synchronous Generators and Motors, Permanent Magnet Machines and Brushless DC machines: Theory of operation, Time constants and reactances, active and reactive power control, starting, full performance analysis. Direct and quadrature axis representation. DC Motors and Generators: Theory of operation, armature reaction, commutation, full performance analysis. Servo motors: Theory of operation, performance analysis.

**Course Code:** EENG 355

**Course Title:** Microprocessors and Applications

Basic microprocessor and microcomputer architecture models. Programming Techniques. Addressing modes. Assembly language. Standard Microprocessor instruction set. Assembly-language programming. Computer buses and parallel I/O. Interfacing Methods. Interrupts and interrupt service routines. Timers and Sequential Applications. Serial input/output. Analog input and output. Typical Applications of Microprocessors in Power Engineering.

**Course Code:** EENG 381

**Course Title:** Control Systems

Introduction to control systems. Representation of physical control system elements. Analogies, Transfer functions, Signal flow graphs. State space analysis. Sensitivity, static accuracy and transient response. Stability of control systems: Routh criterion, Root locus, Frequency response methods, Nyquist stability criterion. Compensation techniques. Introduction to digital control and the Z transform. Discrete time control system.

**Course Code:** EENG 291

**Course Title:** Industrial Training I

In this industrial training course all students must participate in an approved training program in the relevant industry, developing a multidisciplinary and teamwork experience. At the completion of 300 hours of supervised training each student must submit a formal report and oral presentation.